FPL 53 – Corky Root Disease

The information accessed from this screen is based on the publication: Sluggett, L.J. 1972. Corky Root Disease of Douglas-fir Nursery Seedlings. Forestry Canada, Forest Insect and Disease Survey, Forest Pest Leaflet No. 53 5p.

Introduction

Corky root disease of Douglas-fir, [(Pseudotsuga menziesii (Mirb.) Franco)], was first observed in British Columbia at the Quinsam Forest Nursery near Campbell River, in 1963. The fungus Cylindrocarpon destructans (Zinnsm.) Scholten and the nematode *Xiphinema bakeri* Williams are associated with the diseased seedlings, but recent studies indicate the nematode is the "primary" pathogen, and research is now centered on it. The nematode has been found in almost all coastal nurseries of British Columbia and several in Washington and California. Damage assessment surveys showed that 700,000 Douglas-fir seedlings and transplants were ruined at Duncan and Green Timbers ... series in 1969, and more than 800,000 at the Campbell River nursery in 1971-72.

Hosts and Distribution

The disease is most severe on Douglas-fir, but it has also been observed on seedlings of Sitka spruce (Picea sitchensis (Bong.) Carr.), white spruce (P. glauca (Moench) Voss) and western hemlock (Tsuga heterophylla (Raf.) Sarg.) growing in *Xiphinema bakeri* - infested nursery soil. In a recent host-suitability study, X. bakeri populations increased on 16 of 31 plant species. These included strawberries and eight weed species, the greatest population increase occurring on Mouse-ear chickweed.

Corky root has been found in several forest nurseries in the lower Fraser Valley and on Vancouver Island. It has not been reported east of the Coastal Mountains, probably due to the failure of X. bakeri to survive the cold winters, nor in coastal nurseries established on farmland. Affected nursery compartments have moderately to well-drained, sandy silt or silt loam soils and have carried young Douglas-fir seedling crops for at least 16 years. The distribution of the nematode suggests that it is spread by cultivation, landfill or outwash from nearby slopes forested with Douglas-fir.

Life History of the Causal Organisms

Xiphinema bakeri is a rather typical ectoparasitic nematode (Phylum Nematoda), i.e., it is worm-like (length = 3.8 mm; diam = 0.05 mm), possesses a spear-like stylet for feeding on plant root cells and is oviparous (egg-laying). After the eggs hatch, the nematodes pass through four developmental stages before becoming adults. Males are rare and are possibly non-functional. The developmental stages can be identified by length of the body, presence of a replacement stylet and tail shape. Populations of X. bakeri fluctuate annually, increasing sharply in May or June to a maximum in August, declining slowly until November and

remaining low until the following spring. The fluctuation of egg bearing females follows roughly the same cycle, but is more pronounced.

Recognition

Corky root symptoms include swollen tap and lateral roots, lack of lateral roots and stunted chlorotic shoots (Fig). Dark, corky-looking roots contrast with white fleshy tips and light-brown upper part of healthy roots (Fig). Root swelling is caused by an enlarged cortex which persists for at least two growing seasons, in contrast to healthy roots which rapidly slough off the cortex. The tap-root often terminates in a club-shaped swelling and sometimes new roots are formed just behind this terminal clubbing. Sometimes, there is a single, abnormally long root, but generally roots are much shorter than in healthy plants. The lack of lateral roots is probably caused by a reduction in growth of the pericycle. Stunted shoot growth and chlorosis is likely due to the inability of the diseased roots to take up sufficient nutrients for normal growth. This symptom may be confused with soil defects, e.g., nutritional, pH, compaction and flooding problems. Symptoms first appear randomly on 1-0 seedlings during late summer-early fall, and as the disease progresses, patches of diseased seedlings become evident. These patches may coalesce and in 2-0 stock, form disease centres 20-200 feet in diameter.

Damage

Feeding of *Xiphinema bakeri* takes place at root tips and causes darkening, swelling and cessation of root growth. Cell walls are punctured with the stylet and feeding occurs on each cell in a column, progressing inward from the epidermis. Corky root incidence and severity shows a positive correlation with X. bakeri populations. Seedlings which germinate in soil, moderately to heavily infested with the nematode, have a poorly developed root system and a severely stunted chlorotic shoot (Fig). Damaged spruce and hemlock are usually frost-heaved during the first winter due to scarcity of lateral roots. Seedlings which are not attacked until the latter part of the first growing season or their second year are stunted and may not be suitable for outplanting. X. bakeri is indigenous to coastal forests, and when these areas are cleared and converted to nurseries, the populations build up to damaging levels, especially in areas where high seedling demand necessitates continuous cropping for several years.

Control

Preplant application of 15 to 60 Imperial gallons per acre of D-D nematicide (Shell Canada Ltd.) or methyl bromide soil fumigation give excellent *Xiphinema bakeri* and corky root control. When using these materials, the manufacturer's recommendations should be followed and they should be applied during late summer to early fall when soil temperature

and moisture are optimum. Fallowing accompanied by frequent discing also controls the nematode, because of the high soil temperatures, frequently reaching 100ºF in the top inch of soil, and soil dryness which kills the nematodes. To prevent introduction and spread of the nematode into non-infested areas within and between nurseries, fill, peat and other soil amendments should be checked for nematodes, and diseased stock should not be transplanted into non-infested soils.

References

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Figures

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Figure 240-0078. Abnormal roots of a Douglas-fir seedling affected by corky rood disease.

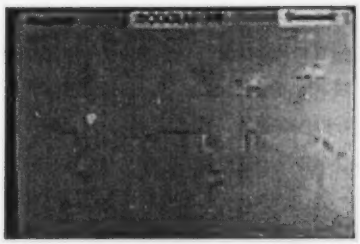

Figure 240-0079. Healthy (2 on left) and diseased (2 on right) Douglas-fir seedlings affected by corky root disease.

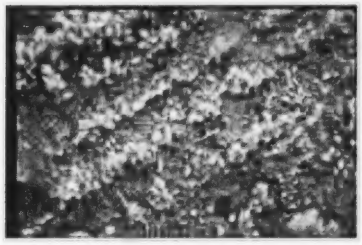

Figure 240-0077. Stunting and foliar discolouration of Douglas-fir seedlings affected by corky root disease.